CALGIUS LONGICAUDATUS BRADY, 1899 (CALIGIDAE: COPEPODA)

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INTRODUCTION

In 1899 Brady described and illustrated a single specimen of *Caligus* obtained in a surface plankton-net tow at Port Chalmers, New Zealand. Both his description and figure were inadequate for identification of the species; the figure erroneously depicted the 2nd antennae and omitted the sternal furca and 1st thoracopods, etc. One cannot be certain even of the sex although Hewitt (1963), who further described the species from Brady's figure, thought the specimen to be a male. Aside from a listing by Hutton (1904), the binomen had not been mentioned again in the literature until 1963. Cleugh (1966) disagreed with Hewitt's proposal for a new name and argued that the name *C. longicaudatus* Brady was valid; but he called attention to the facts that the species was founded on a single specimen, was inadequately described, and required validation.

A letter to Dr. J. P. Harding quickly established that Brady's specimen existed in the British Museum (Natural History). Through the efforts of Miss Patricia Lofthouse, Entomostraca Section, the Trustees of the Museum kindly loaned Brady's specimen for examination.

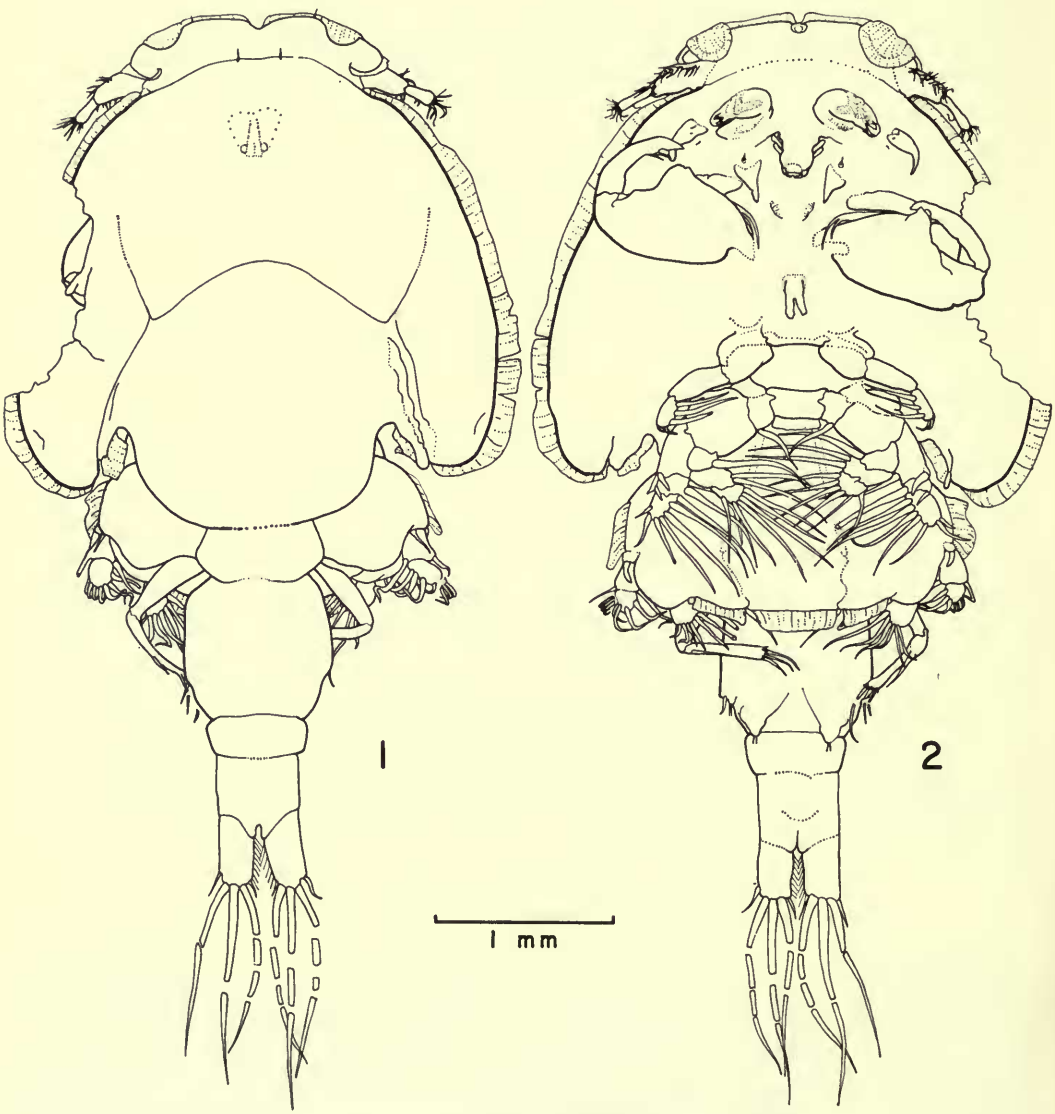
The specimen was mounted, ventral side up, on a glass slide. The cover slip was crazed, having been supported by the large maxillipeds while the mountant had shrunk. The specimen could not be examined in that condition. From the report by Stock (1960) it was learned that Brady's specimens were usually mounted in a glycerin–gelatin medium and could be recovered by soaking in water. (Dr. Stock's description of the state of the mounted specimens aptly applies in the present case.) Thus it was possible to recover the specimen, which was severely damaged, and by clearing with lactic acid, to redescribe it. The specimen was drawn in detail, using a camera lucida, by Miss Margaret Dean of this laboratory. I am also indebted to Dr. Z. Kabata and to Dr. L. Margolis for consultation in this project. The specimen has been returned to the British Museum (Natural History), as No. 1951.8.10.141 Type, in ethanol. The following redescription presents all of the detail which could be discerned from the type specimen. I have deliberately presented a very brief verbal account, relying upon the figures for anatomical detail.

Caligus longicaudatus Brady, 1899

The specimen is a male. Exclusive of the terminal spines of the caudal lamellae the total length was 4·93 mm, (Brady gave 5 mm.). From the dorsal aspect (Text-fig. 1) the carapace length including the frontal lobes is 58% the total length or approximately 2·84 mm. The maximum width of the carapace measured 2·93 mm., however the specimen was severely flattened in its former mount and did not regain its original shape. The dorsal surface of the carapace was marked with scattered

minute branched cilia, positioned in a bilaterally symmetrical pattern. Their function is unknown to me. Similar cilia also were found on the dorsal surface of the 3rd thoracopods, the 4th and genital segments, and the abdomen. The abdomen is of 2 segments, the anterior being slightly wider but about half the length of the posterior segment. The caudal lamellae bear the usual 3 small and 3 large ciliated setae (cilia not shown) and the entire medial edge of each lamella is ciliated.

From the ventral aspect (Fig. 2) the lunules appear semi-circular and prominent.



FIGS. 1–2. *Caligus longicaudatus*. 1. Dorsal view. 2. Ventral view.

The frontal plates are about 0·23 mm. long and are bordered by a hyaline fringe broken at the midline by the embryonic cement gland.

Cephalic appendages are shown in larger detail in Text-figs. 3–9. *Antennules* (Text-fig. 3) are composed of 2 segments. The basal segment bears 25 spines ventrally and 2 spines dorsally which are arranged along the lateral edge. Twenty-three of the ventral spines are definitely ciliated (cilia not illustrated). The remaining 2, situated at about mid-length, are thought to be naked. The 2 dorsal spines are ciliated. The tip of the distal segment bears 13 naked spines, 2 of which appear to have a common base. A 14th naked spine originates from the medial edge at about mid-length of the segment. As is shown in Fig. 3, the spines of the basal segment are of variable lengths, but are relatively long for members of this genus; 2 spines originating from the distal edge project nearly to the tip of the distal segment. *Antennae* (Text-fig. 4) are modified as is usual for the male and are composed of at least 3 segments (a basal segment may be incorporated into the ventral cephalic surface). The first and second segments are sculptured with adhesion pads. The distal segment is modified into a small claw which bears a fine membrane along each edge. Originating with these membranes are 2 accessory spines.

The *post-antennary* process (Text-fig. 5) is strongly developed, slightly hooked and pointed. Two papillae on the base give rise to hair-like setae and a third papilla near the base gives rise to an additional hair-like seta.

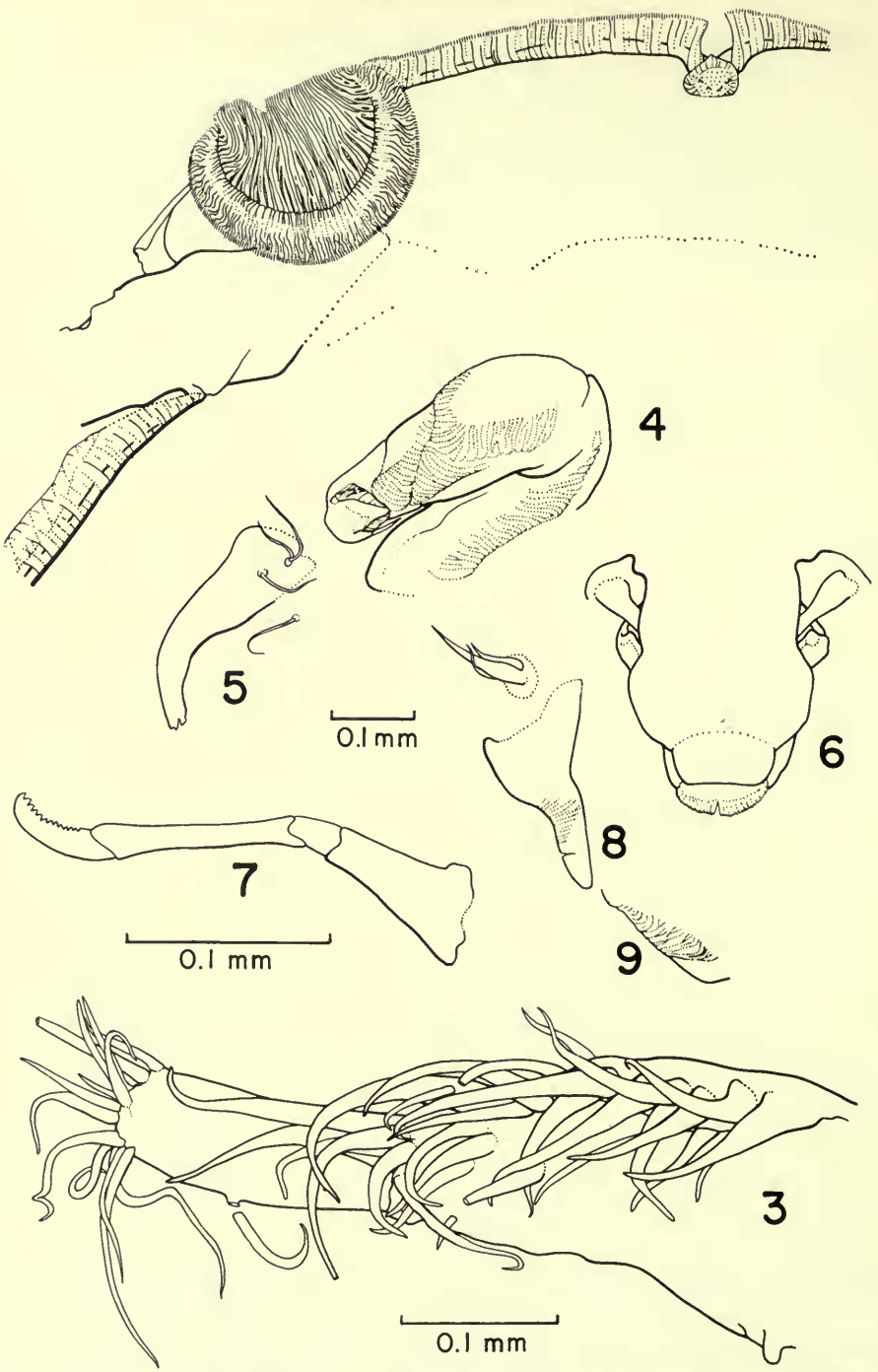
The *mouth cone* (Text-fig. 6) is the usual tube-within-a-tube structure with the mandibles entering mandibular tubes (formed by involutions of the ectoderm) near the base of the mouth cone. The mandibular tubes penetrate the mouth cone distally, thus separating the cone into dorsal and ventral flaps. A circular flap, apparently separated from the ventral flap proper, extends the ventral region of the mouth cone and is bordered distally by a fringed membrane. A similar membrane is thought to border the dorsal flap.

Mandibles (Text-fig. 7) are composed of 4 segments; the distal segment bears 12 teeth on the medial edge.

The *maxillules* (Text-fig. 8) are largely incorporated into the ventral integument. Anteriorly a papilla bears 3 flattened spines of dissimilar lengths. Posteriorly the maxillule is represented by a prominent heavy spine. Faint striations were seen on the distal half along the ventro-lateral edge. Posterior to the maxillules are a pair of adhesion pads (Text-fig. 9) which may be of taxonomic significance.

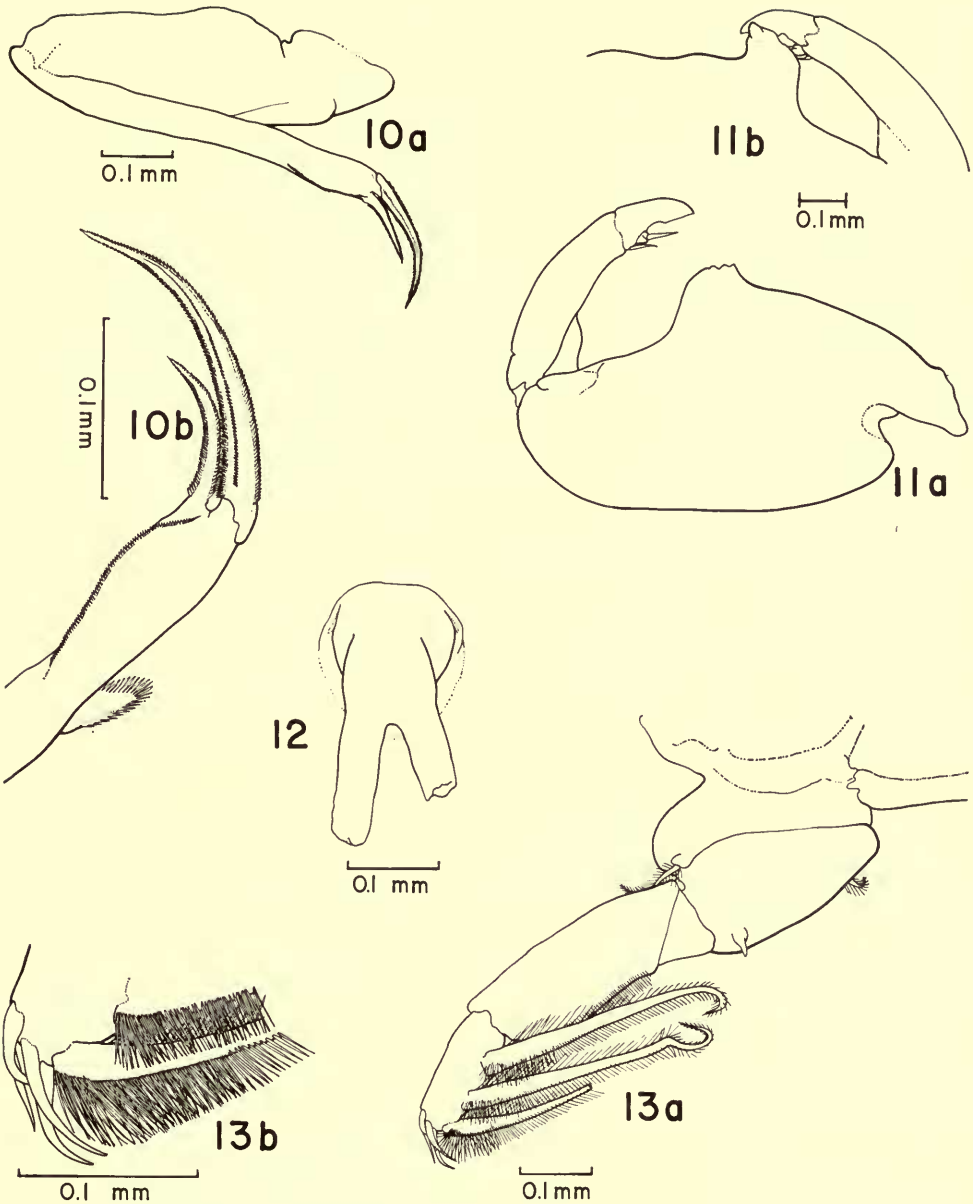
Maxillae (Text-fig. 10a, b) are interpreted to be composed of 4 segments. The basal segment is short and heavy, followed by an equally thick but long second segment. The 3rd segment is long and slender and bears the usual fringed lappet about two-thirds the segment length distally. In addition, a clearly defined fringe extends from this lappet distally to the base of the fourth segment. The laterodistal corner is extended into a prolonged pointed extension, fringed along both borders. The 4th segment is nearly one-third the length of the third segment, tapers to a point and bears 3 definite rows of cilia along its length, possibly a fourth row dorsally, which are so spaced to divide the circumference into 4 equal parts.

The *maxillipeds* (Text-fig. 11a, b) are strongly developed, as is usual for males of the genus. The medial edge is developed into a protruding rough spine into which the



FIGS. 3–9. *Caligus longicaudatus*. 3. Right antennule, ventral view. 4. Right antenna, *in situ*, ventral view. 5. Right post-antennary process, *in situ*, ventral view. 6. Mouth cone, *in situ*, ventral view. 7. Left mandible, ventral view as seen in the mouth cone. 8. Maxillule, *in situ*, ventral view. 9. Adhesion pads, *in situ*, ventral view.

FIGS. 4, 5, 6, 8 and 9 are depicted in positional relationship to the frontal membrane and and lunule show above them as seen from ventral view.



FIGS. 10a–13b. *Caligus longicaudatus*. 10a. Right maxilla, ventral view. 10b. Enlargement of apical end of left maxilla, ventral view. 11a. Right maxilliped, ventral view. 11b. Portion of left maxilliped, ventral view. 12. Sternal furca, ventral view. 13a. Right 1st thoracopod, ventral view. 13b. Enlargement of apical portion of right 1st thoracopod.

tip of the maxilliped fits when closed. The 2 distal segments together form a claw. At the suture line, on the distal segment, are located 2 small spines. The distomedial edge of the apical segment is sharp, resembling the blade of a knife.

The *sternal furca* (Text-fig. 12) of the specimen is damaged, however the right prong is flattened and slightly spatulate at the tip.

The *1st thoracopods* (Text-fig. 13a, b) consist of a 2-segmented protopod and a 2-segmented exopod. The endopod is represented by a small papilla projecting into a minute spine. The 4 apical spines of the distal exopodal segment are unbranched and apparently naked.

The *2nd thoracopods* (Text-fig. 14) consist of a 2-segmented protopod, and 3-segmented exopod and endopod.

The *3rd thoracopods* (Text-fig. 15) are not unusual. The heavy spine on the 1st exopodal segment is flattened, curved, with a knife edge laterally. Dorsally, a small, ciliated (cilia not shown Text-fig. 1) spine originates from the protopod and projects over the base of the exopod.

The *4th thoracopods* (Text-fig. 16) are composed of 3 segments; the lateral edge of the distal segment does not posess a spine. The apical spines of the 2nd and 3rd segments are finely ciliated along both borders. Those of the 3rd segment are covered at their bases by finely pectinated lamellae.

The *5th thoracopods* (Text-fig. 17) are represented by 2 papillae, the lateral one bears a single ciliated spine, the medial papilla bears 2 similar ciliated spines.

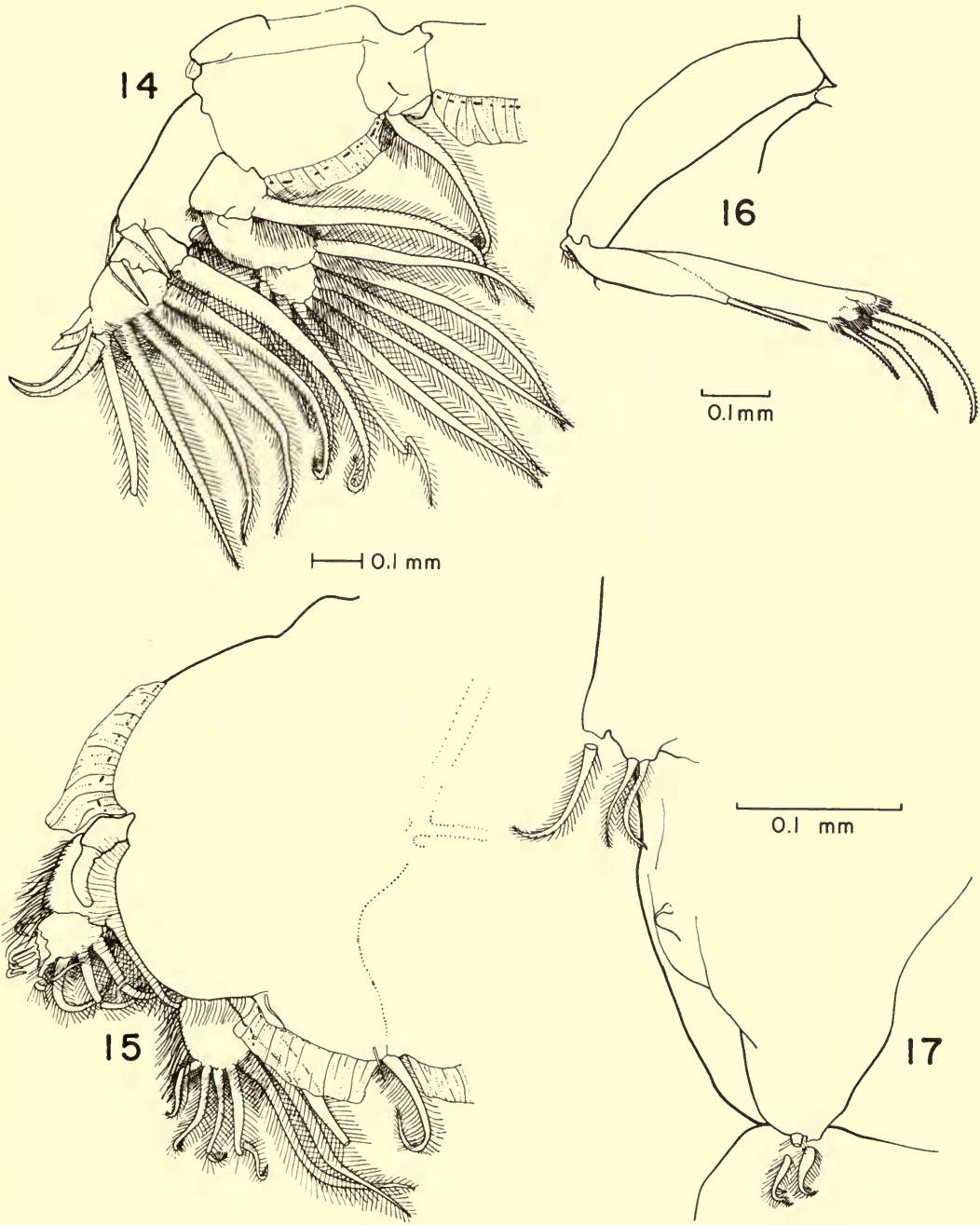
The *6th thoracopods* (Text-fig. 17) are found caudally on the ventral surface of the genital segment. They consist of a pair of caudally projecting lobes terminated by 2 ciliated spines. A small naked spine is located on the genital segment between the 5th and 6th thoracopods.

DISCUSSION

While Brady's name *C. longicaudatus* is available for his specimen it remains to be determined if the species was described prior to 1899[1] under another name. According to our records there were 108 species named to the genus prior to that date. Of these 32, as listed in Table I, are recognized as belonging to other genera. Included in this list is *C. lessonius* Risso, 1826, described as possessing foliaceous plates attached to the first 2 segments of the abdomen. A further 20 species, as listed in Table II, are recognized to be junior synonyms of previously described species. Included here is *C. appendiculatus* F. Müller, 1852, described from a chalimus stage found on *Cyprinus rutilus* on the shore of the Baltic Sea. The binomen was last mentioned by Nordmann (1864), i.e. more than 100 years ago. Therefore, according to Article 23(b) of the International Code of Zoological Nomenclature (1961), it has no status. It is obvious, however, that Müller described a juvenile male *C. lacustris* Steenstrup and Lütken, 1861. The male of this species was not figured nor adequately described until Redeke's 1939 paper.

In Table III a list of 13 species names considered *nomina nuda* is presented. Only by examining the type material can the status of these species be established. All

[1] Although 1901 is the commonly quoted date of publication of Brady's paper, it appeared as a separate in 1899 and was bound, with other sections, into a volume issued in 1901.



FIGS. 14–17. *Caligus longicaudatus*. 14. Right 2nd thoracopod, ventral view. 15. Right 3rd thoracopod, ventral view. 16. Right 4th thoracopod, ventral view. 17. Ventral view of left caudal portion of genital segment showing 5th and 6th thoracopods.

but two of the remaining species are grouped in Tables IV to VI according to anatomical features which readily distinguish them from *C. longicaudatus*.

The two species remaining for consideration are *C. lacustris* Steenstrup and Lütken, 1861, and *C. longipedis* Bassett-Smith, 1898c. *C. lacustris* has only been reported from fresh water or from freshwater fishes which have been found in estuarine waters of low salinity. The comparative lengths of the apical spines of the 4th thoracopod are completely dissimilar to those of *C. longicaudatus*. *C. longipedis* also can be separated from *C. longicaudatus* by the relative much longer length of the 4th thoracopods of the former, although the two species are in many ways similar.

It is concluded that *C. longicaudatus* Brady, 1899, is a valid species although known only from a single male specimen taken in a surface townet.

Of the 187 species named to the genus *Caligus* since 1899 there are 162 considered valid members of the genus today. I have compared the descriptions of these species with *C. longicaudatus* and cannot definitely assign any of the former to the latter species. *C. pterois* Kurian, 1949, and *C. debueni* Stuardo and Fagetti, 1960, are so incompletely described that no comparison is possible. *C. brevicaudatus* A. Scott, 1901, and *C. calotomi* Shiino, 1954, are known from females only. These species are similar to *C. longicaudatus* in many morphological details, i.e., thoracopod structure and the sternal furca, yet the gross body proportions may indicate dissimilarity. *C. tetrodontis* Barnard, 1948, is incompletely described. From the details provided by Barnard the species may be identical. These five species are given the status *species inquirenda*.

It is not surprising that *C. longicaudatus* has not been reported since 1899. Relatively little work on the caligids has taken place in New Zealand waters. From the description provided herein it should now be possible to recognize *C. longicaudatus* Brady, 1899, and it should be looked for in the New Zealand fauna.

TABLE I

List of *Caligus* species named prior to 1899 transferred to other genera

Caligus sp.	Author	Transferred by
productus n. sp.	Müller, 1785	Latreille, 1829
crassus n. sp.	Abildgaard, 1794	Krøyer, 1837–1839
oblongus n. sp.	Abildgaard, 1794	Krøyer, 1837–1839
imbricatus n. sp.	Risso, 1816	Desmarest, 1825
piscinus n. comb.	Lamarck, 1818 (in part)	Krøyer, 1837–1839
bicolor n. comb.	Lamarck, 1818	Baird, 1850
smithii n. comb.	Lamarck, 1818	Baird, 1850
heptapus n. sp.	Otto, 1821	Krøyer, 1837–1839
molvae n. sp.	Latreille, 1825[1]	Wilson, 1905
lessonius n. sp.	Risso, 1826	(see text)
paradoxus n. sp.	Otto, 1828	Krøyer, 1837–1839
pharaonis n. sp.	Nordmann, 1832	Humes, 1965
hippoglossi n. comb.	Krøyer, 1837–1839	Baird, 1850
pectoralis n. comb.	Krøyer, 1837–1839	Baird, 1850

TABLE I—*contd.*

Caligus sp.	Author	Transferred by
salmonis n. sp.	Krøyer, 1837–1839	Smith, 1874
sturionis n. sp.	Krøyer, 1837–1839	Wilson, 1905
nordmannii n. sp.	Milne-Edwards, 1840	Baird, 1850
ornatus n. sp.	Milne-Edwards, 1840	Bassett-Smith, 1899
vespa n. sp.	Milne-Edwards, 1840	Baird, 1850
strömii n. nom.	Baird, 1848	Baird, 1850
gracilis n. sp.	Van Beneden, 1851	Carus, 1885
bagri n. sp.	Dana, 1852	Dana, 1853
branchialis n. sp.	Malm *in* Steenstrup and Lütken, 1861	Bassett-Smith, 1899
heckelii n. sp.	Kollar *in* Krøyer, 1863	Krøyer, 1863–1864
macrurus n. sp.	Heller, 1865	Yamaguti, 1963
pacificus n. sp.	Gissler, 1883	Wilson, 1905
brevipedis n. sp.	Bassett-Smith, 1896a, b	A. Scott, 1901
obscurus n. comb.	Bassett-Smith, 1896b	Bassett-Smith, 1899
nautili prov. n.	Willey, 1896	Stebbings, 1900
benedeni n. sp.	Bassett-Smith, 1898a	Bere, 1936
hirsutus n. sp.	Bassett-Smith, 1898a	Wilson, 1912
parvus n. sp.	Bassett-Smith, 1898a	Rangnekar and Murti, 1964

[1] I have been unable to locate this reference.

TABLE II

List of species names junior in synonomy within the genus *Caligus* (prior to 1899)

Caligus sp.		Authority
mülleri n. sp.	Leach, 1816	Krøyer, 1837–1839
piscinus n. comb.	Lamarck, 1818 (in part)	Krøyer, 1837–1839
bicuspidatus n. sp.	Nordmann, 1832	Nordmann, 1832
americanus n. sp.	Pickering and Dana, 1838	Steenstrup and Lütken, 1861
minutus n. nov.	Krøyer, 1837	Heller, 1866
leptochilus n. sp.	Frey and Leuckart, 1847	Steenstrup and Lütken, 1861
appendiculatus n. sp.	F. Müller 1852	(see text)
elegans n. sp.	Van Beneden, 1851	Steenstrup and Lütken, 1861
coryphaenae n. sp.	Steenstrup and Lütken, 1861	Pillai, 1963
abbreviatus n. sp.	Krøyer, 1863–1864	T. Scott, 1905
aeglefini n. sp.	Krøyer, 1863–1864	Wilson, 1905
carangis n. sp.	Krøyer, 1863–1864	Wilson, 1905
fallax n. sp.	Krøyer, 1863–1864	Dollfus, 1953
lumpi n. sp.	Krøyer, 1863–1864	Olsson, 1869
monacanthi n. sp.	Krøyer, 1863–1864	Wilson, 1905
nanus n. sp.	Krøyer, 1863–1864	Parker, 1965
borealis n. sp.	Olsson, 1877	Markevich, 1956
bengoensis n. sp.	T. Scott, 1894	Bassett-Smith, 1899
scomberi n. sp.	Bassett-Smith, 1896b	Wilson, 1905
longicaudus n. sp.	Bassett-Smith, 1898a	Bassett-Smith, 1899

Table III

List of *Caligus* species named prior to 1899 considered *nomina nuda* or *species inquirenda*

Caligus sp.	
scutatus	Milne-Edwards, 1840[1]
cristata	Gould, 1841
gayi	Gay, 1849
gracilis	Dana, 1852
scrombri	J. V. Thompson *in* W. Thompson, 1856
platessae	Van Beneden, 1871
lepidopi	Richiardi, 1880
petersii	Richiardi, 1880
serrani	Richiardi, 1880
smaris	Richiardi, 1880
trachini	Richiardi, 1880
trachuri	Richiardi, 1880
fissus	Richiardi, 1880

[1] The type material is not at the Museum National D'Histoire Naturelle, Paris.

Table IV

List of *Caligus* species named prior to 1899 characterized by absence of 3 ciliated spines on medial margin, distal segment of 1st thoracopod (not included in Tables I–III)

Caligus sp.		Spines
productus	Dana, 1852	absent
alalongae	Krøyer, 1863–1864	absent
trichiuri	Krøyer, 1863–1864	present but naked
haemulonis	Krøyer, 1863–1864	absent
affinis	Heller, 1866	absent
dakari	Van Beneden, 1892	absent

Table V

List of *Caligus* species named prior to 1899 characterized by 4th thoracopods composed of 4 segments (not included in Tables I–IV)

Caligus sp.

diaphanus	Nordmann, 1832
thymni	Dana, 1852
isonyx	Steenstrup and Lütken, 1861
chorinemi	Kollar *in* Krøyer, 1863–1864
pelamydis	Krøyer, 1863–1864
constrictus	Heller, 1865
tenax	Heller, 1865
torpedinis	Heller, 1865[1]
trachynoti	Heller, 1865
vexator	Heller, 1865
murrayanus	T. Scott, 1894
arii	Bassett-Smith, 1898b
cybii	Bassett-Smith, 1898a
phipsoni	Bassett-Smith, 1898a
platytarsis	Bassett-Smith, 1898b
robustus	Bassett-Smith, 1898c

[1] Brian, 1924, considered *C. torpedinis* a possible synonym of *C. diaphanus* Nordmann.

Table VI

List of *Caligus* species named prior to 1899 characterized by 4th thoracopod composed of 3 segments, with a spine present on lateral edge of the distal segment in addition to 3 terminal spines (not included in Tables I–IV)

Caligus sp.

elongatus	Nordmann, 1832[1]
kroyerii	Milne-Edwards, 1840[2]
rapax	Milne-Edwards, 1840[2]
rissoanus	Milne-Edwards, 1840[2]
angustatus	Krøyer, 1863–1864
belones	Krøyer, 1863–1864
gurnardi	Krøyer, 1863–1864
stromatei	Krøyer, 1863–1864
trachypteri	Krøyer, 1863–1864
infestans	Heller, 1865
irritans	Heller, 1865
dubius	T. Scott, 1894
cossackii	Bassett-Smith, 1898b

[1] Type material was obtained from Institut für Spezielle Zoologie und Zoologisches Museum, Berlin and examined by the author. This loan was arranged through the kindness of Dr. H. E. Gruner, Humboldt-Universität zu Berlin.

[2] Type material was obtained from the Paris Museum and examined by the author. This loan was arranged through the kindness of Dr. J. Forest, Museum National D'Histoire Naturelle, Paris.

Table VII

List of *Caligus* species named prior to 1899 of which the male is characterized by an abdomen composed of a single segment (not included in Tables I–VI)

Caligus sp.	
curtus	O. Müller, 1785
minimus	Otto, 1821
centrodonti	Baird, 1850
balistae	Steenstrup and Lütken, 1861
cheilodactyli	Krøyer, 1863–1864
hyalinus	Chernyavsky, 1868

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